# Angle Between Lines

**29–30** Find the acute angle between the lines.

**29.** $2x - y = 3, \quad 3x + y = 7$

**30.** $x + 2y = 7, \quad 5x - y = 2$

**Q12.3-29 from Calculus: Early Transcendentals 7e by Stewart**

**Why**: Find the dot product between two vectors.

**Steps**:
1. Find the slope of each line.
2. Use the dot product formula to calculate the angle between the lines.

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(1) Slope of each line:

$2x - y = 3$
$y = 2x - 3$

$m_1 = 2$

$3x + y = 7$
$y = -3x + 7$

$m_2 = -3$

(2) Use the dot product formula

$$\vec{a} \cdot \vec{b} = |\vec{a}|\,|\vec{b}|\cos\theta = a_x b_x + a_y b_y$$
$$\Rightarrow \cos\theta = \frac{a_x b_x + a_y b_y}{|\vec{a}|\,|\vec{b}|}$$

$\vec{a} = <1,2>, \vec{b} = <1,-3>$

$$\cos\theta = \frac{(1)(1) + (2)(-3)}{\sqrt{(1)^2 + (2)^2}\sqrt{(1)^2 + (-3)^2}}$$
$$\cos\theta = \frac{-5}{\sqrt{5}\sqrt{10}} = -\frac{5}{\sqrt{50}} = -\frac{5}{\sqrt{25}\sqrt{2}} = -\frac{1}{\sqrt{2}}$$
$$\theta = \cos^{-1}\left(-\frac{1}{\sqrt{2}}\right) = 135°$$
$$180° - 135° = 45°$$